



California ISO

Energy Imbalance Market Overview for WAPA DSW

November 12, 2019

Presenters:

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ISO EIM Agenda

Part 1 – General Briefing

- Foundational Concepts
- Market Efficiencies
- Governance Structure
- Stakeholder Process
- Extended Day-Ahead Market

Part 2 – EIM Training Concepts

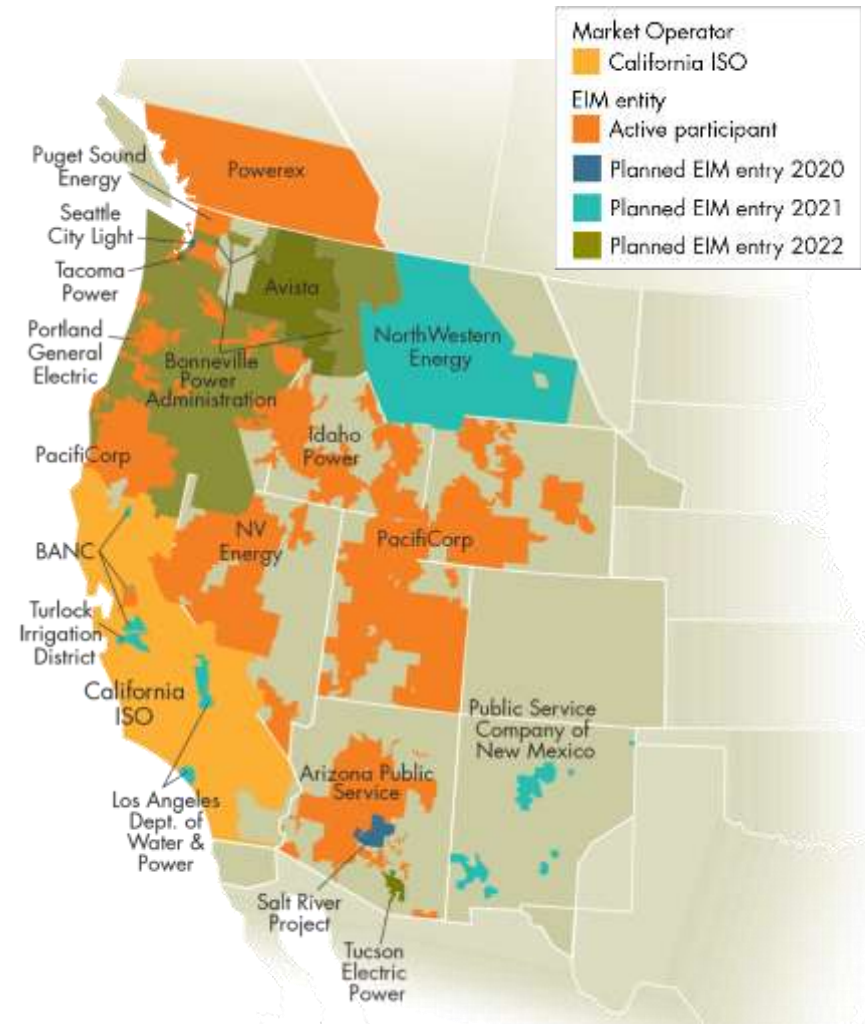
- EIM Readiness
- EIM Resources: Participating vs. Non-Participating
- EIM Market Timing
- Resource Plans
- EIM Tools

Part 3 – Reference

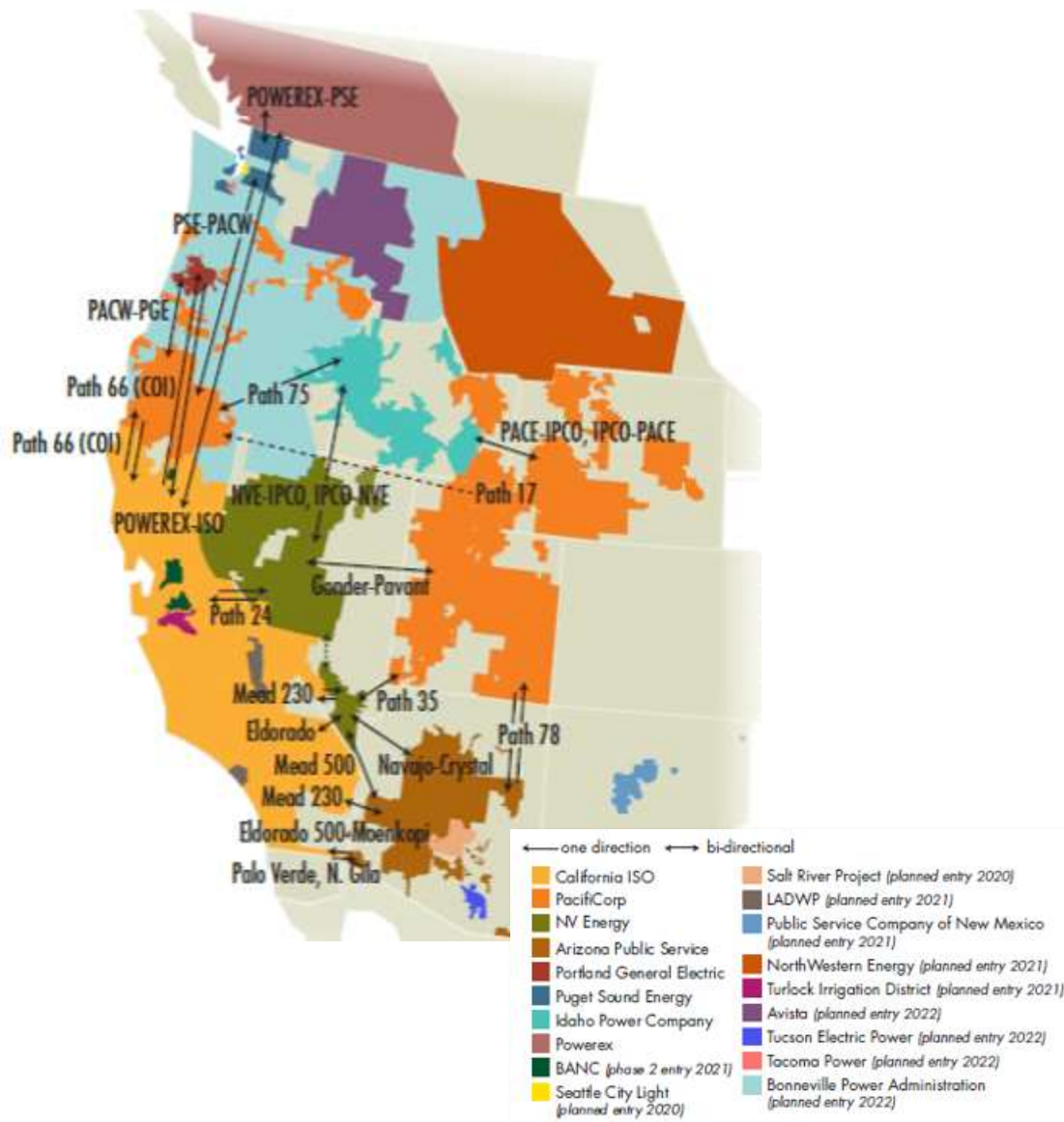
- Information

The Western Energy Imbalance Market

- Automated dispatch minimizes cost, facilitates renewables, resolves imbalance, avoids congestion
 - Situational awareness enhances reliability
 - Harmonizes with bilateral trading and regional reserve sharing groups
 - Preserves Balancing Authority Area (BAA) autonomy, including compliance, balancing and reserve obligations
 - Benefits from EIM operation total \$801 million through Q3 2019
- <https://www.westerneim.com/pages/default.aspx>



Market efficiencies depend on robust transmission



Path	Estimated Max Capacity (MW)
Path 24 (west to east)	100
Path 24 (east to west)	35-90
Eldorado	797
Path 35 (west to east)	580
Path 35 (east to west)	538
Gonder-Pavant	130
PACW to PGE	320
Path 66 (ISO to PGE)	627
Path 66 (PGE to ISO)	296
Path 66 (ISO to PACW)	331
Path 66 (PACW to ISO)	432
Path 17	0-400 ¹ ²
PSE to PACW	300
Eldorado 500-Moenkopi	732
Palo Verde, N. Gila	3,151
Path 78 (PACE to APS)	625
Path 78 (APS to PACE)	660
Navajo-Crystal	522
Mead 500	349
Mead 230 (APS <-> ISO)	236
Mead 230 (ISO to NVE)	3,443
Mead 230 (NVE to ISO)	3,476
IPCO to PACW (Path 75)	1,500
PACW to IPCO (Path 75)	400-510
PACE to IPCO	2,557
IPCO to PACE	1,550
NVE to IPCO	262
IPCO to NVE	390-478
Powerex <-> PSE	150
Powerex <-> ISO	150

¹ Is an optional path available for PACE/PACW EIM transfers and the capacity is a subset of PACE/IPCO/IPCO/PACE and Path 75 capacity.

² When in use, the available capacity on PACE/IPCO/IPCO/PACE and Path 75 will be subsequently reduced by the used amount on Path 17, and not double counted.

Current as of October 2019

Western EIM governance structure

EIM Governing Body (GB)

- 5 independent, non-stakeholder members
- Delegated authority over EIM-related market rules
- Selected by stakeholder nominating committee, confirmed by EIM Governing Body
- Provides western entities a decision-making voice

EIM Body of State Regulators (BOSR)

- Advises the EIM Governing Body and ISO Board of Governors on matters of interest
- Currently eight state officials from EIM states
- Provides a state regulatory perspective

Regional Issues Forum (RIF)

- Public vehicle for discussion of EIM-related issues, including impacts to neighboring balancing authority areas
- Organized by ten self-selected sector liaisons
- May produce opinions for EIM governing body or ISO Board of Governors

Stakeholder input is essential to ISO planning, processes and enhancements



<http://www.caiso.com/informed/Pages/StakeholderProcesses/Default.aspx>

Broad market
enhancements

EIM
enhancements

Process and tool enhancement implementation

Updates are made based greatly upon the input of our customers

EIM provides a low-cost, low-risk option that balances load and resources automatically and economically in the real-time market



- ISO optimizes energy transfer and generation output between all EIM participants in multiple increments
- Single optimization across EIM footprint improves quality and helps overall system reliability



- Currently applies to real-time market only, but a new initiative proposed to extend EIM to day-ahead

Extended Day-Ahead Market (EDAM)

- Extend EIM to include DA market
- Same foundational concepts as EIM:
 - BAA autonomy
 - Voluntary entry
 - No exit fees
- EIM will be maintained as a stand-alone service
- Stakeholder process initiated in October 2019, running through early 2021
- Major topics
 - Transmission availability and pricing
 - Resource sufficiency
 - Greenhouse gas
 - Governance

Follow this initiative under the Stay Informed tab of the ISO website at:
<http://www.caiso.com/informed/Pages/StakeholderProcesses/ExtendedDay-AheadMarket.aspx>

Onboarding & Training

EIM READINESS

EIM Onboarding Tracks

Visit our Western EIM site to find documents detailing these tracks

Training & Readiness

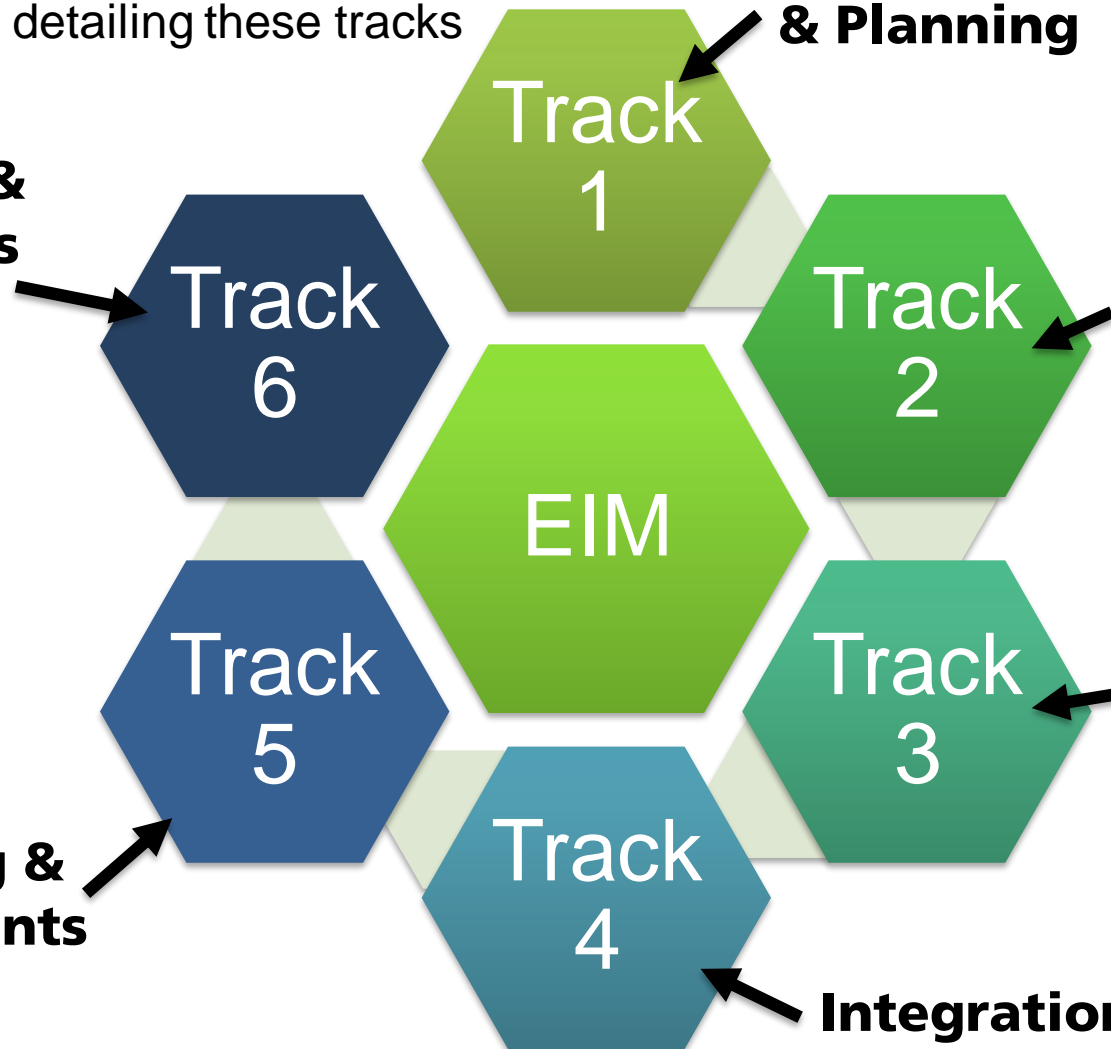
Project Management & Planning

Agreements, User Access & DMM

Full Network Model

Metering & Settlements

Integration and Testing



ISO provides robust initial and ongoing EIM training programs to ensure readiness

- **Level 100**

- Computer Based Training (CBT) Fundamental Concepts
- Settlements 101 Instructor Led Training

- **Level 200**

- Computer Based Training (CBT) Advanced Concepts
- Settlements 201 Instructor Led Training

- **Level 300**

- Train-the-Trainer Course
- Instructor Led Scenario Training

Training is based on rules, regulations, processes and best practices

Reliability and
safety
requirements



**Federal and
Regulatory
Standards**

FERC

NERC

WECC

Rules and
stakeholder
guides



**ISO Tariff and
Business Practice
Manuals**

Step-by-step
instructions &
best practices



**Operating
Procedures
Knowledge
Articles**

Participating vs. Non-Participating

EIM RESOURCES

Who is participating and what does that mean?

Participating Resource

A resource that submits bids that allow the EIM market to dispatch or not dispatch the resource in real-time



Bidding makes resources available to resolve energy imbalances

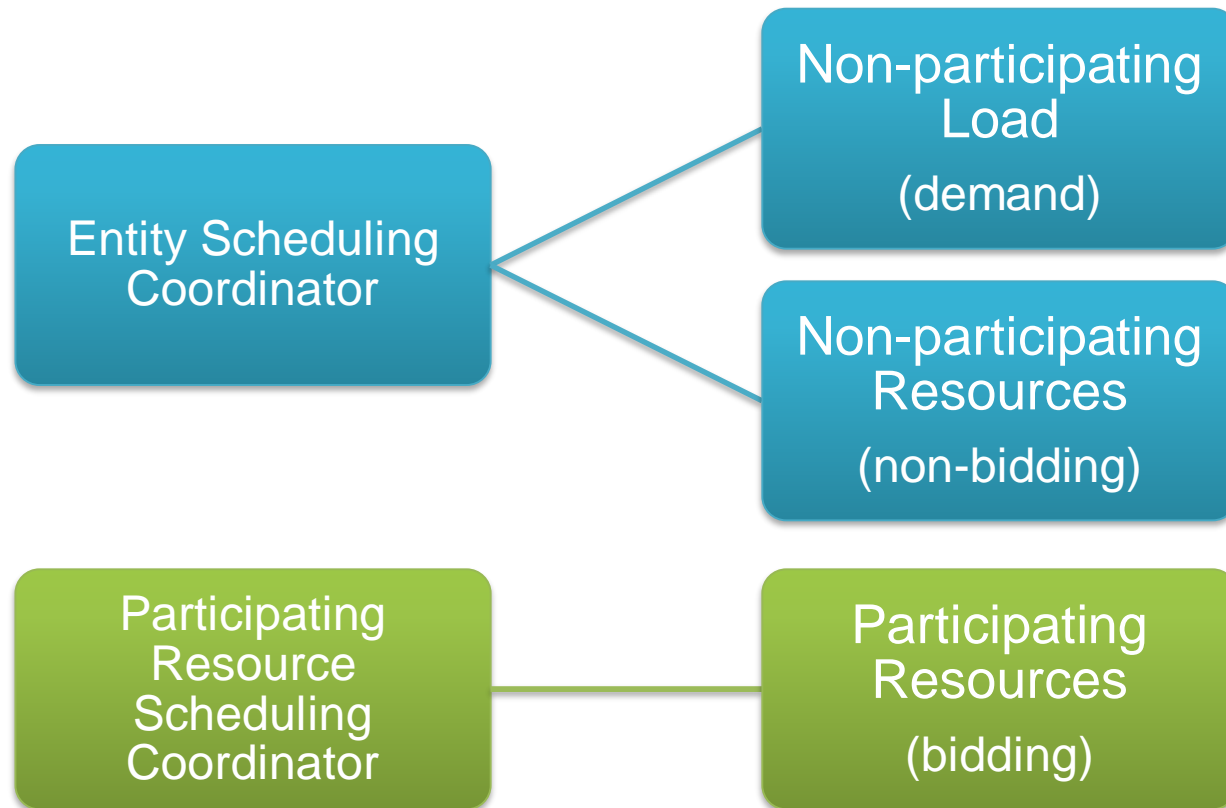
Non-Participating Resource

A resource that intends to operate in the BA but **does not** allow the EIM market to dispatch or not dispatch the resource in real-time



Submits base schedules to ensure BA balancing calculations are accurate

The ISO settles with scheduling coordinators who allocate payments and charges to their customers



EIM Entities allocate the cost based upon their Open Access Transmission Tariff (OATT)

How are base schedules settled?

Participating Resource

- The Market Operator will settle the deviations from base schedules for participating resources at the locational marginal price at the corresponding locations.

Non-Participating Resource

- The EIM Entity Scheduling Coordinator will be responsible for the settlement of deviations from base schedules for these resources.

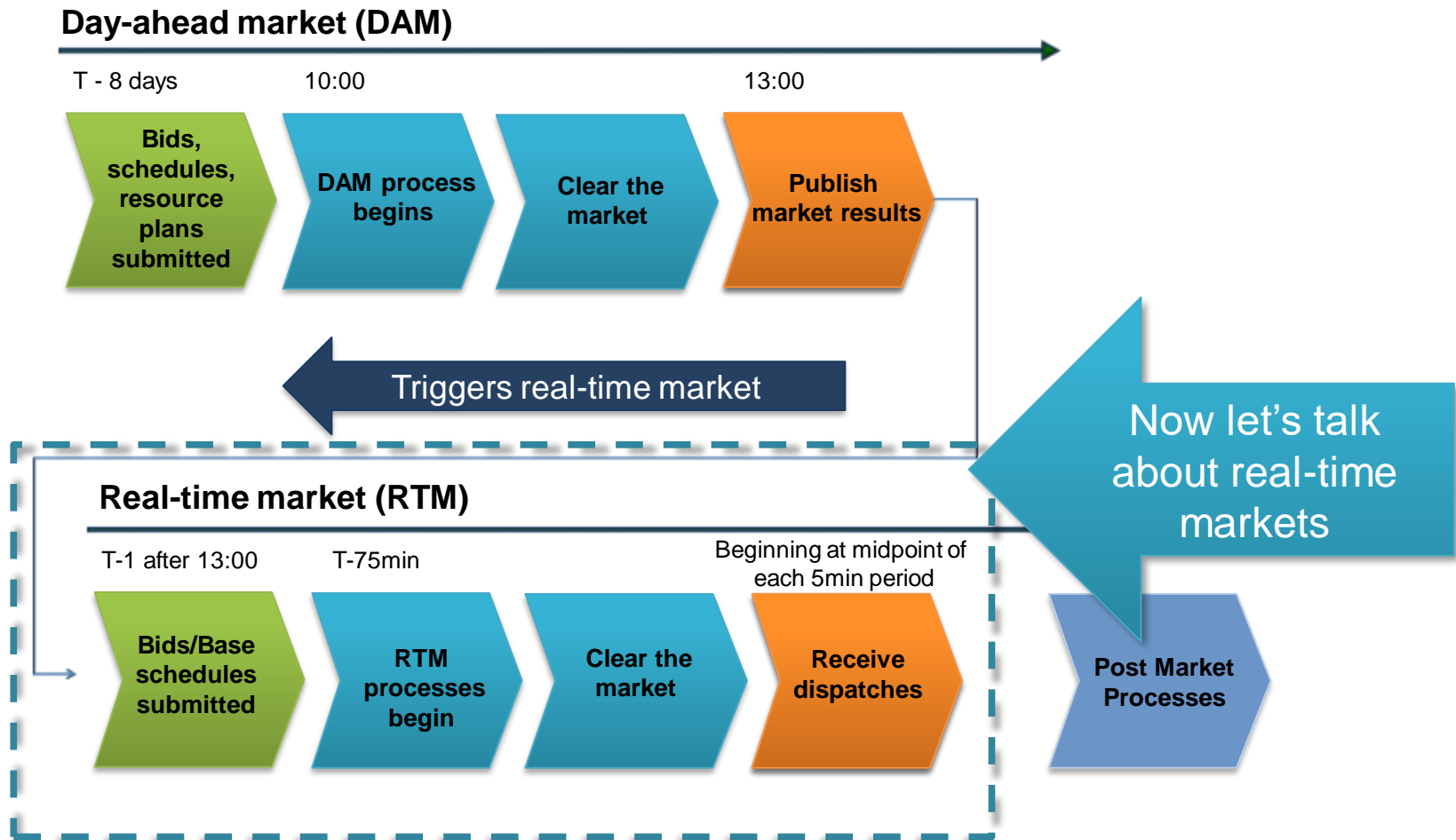
Charge codes allow for greater granularity in the breakdown of charges and payments for greater transparency.

Visit the ISO Settlements page for more information, including the Charge Code Matrix
<http://www.caiso.com/market/Pages/Settlements/Default.aspx>

Real-Time Market

EIM MARKET TIMING

The ISO Markets – Where does EIM fit?



Real-time markets do the following:

Procure “balancing” energy to meet the forecasted real-time grid energy demand



Send dispatch signals to resources to move up or down to meet current system conditions



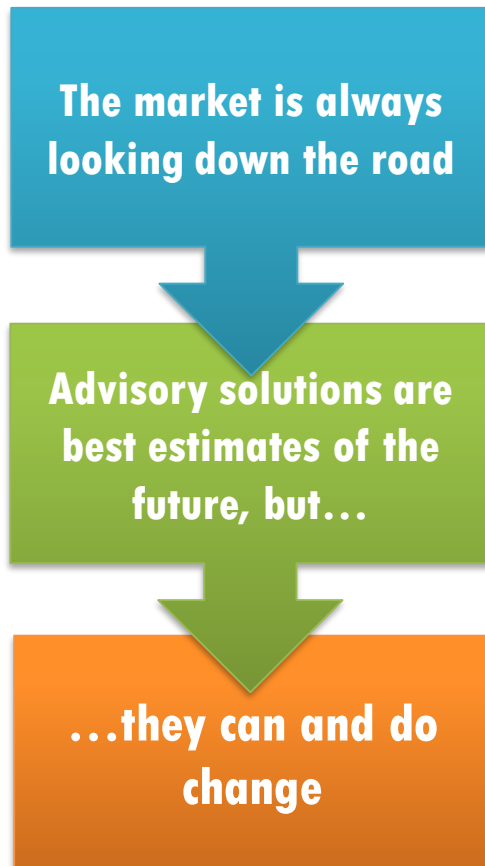
Maintain the security of the system (no normal or post-contingency overload)



Protect operating reserves that the market is aware of



The ISO market looks at resource future targets



The real-time market allows for operators to look ahead at resource usage and commitments

Real-time Outputs: Resource Instructions



Intertie transactions that are **hourly**:

- Submitted by EIM entity
- Critical to be accurate used as baseline

For each **fifteen minute interval** we are:

- Starting-up or shutting down resources
- Transitioning multi-stage generators
- STUC has longer time horizon

For each **five minute interval** we are:

- Issuing real-time dispatch instructions
- No start-ups/shut downs/transitions

Hourly process for real-time market leading up to operating hour (EIM components)

(T- = start of the hour)

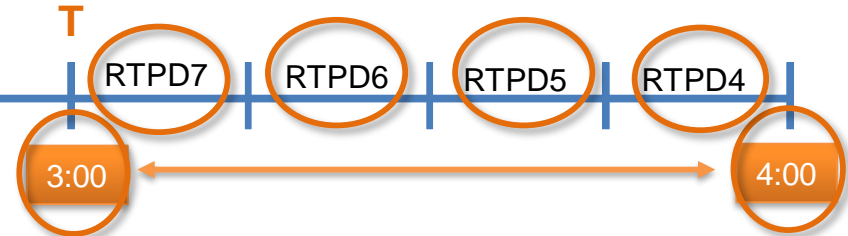
T-75: Base schedules and energy bids due (Resources)

T-55: Updated base schedules are submitted if necessary (Resources)

T-40: Updated base schedules are submitted if necessary (Entity SC)

T-20: E-tagging deadline
(Entity SC)

EIM Market
participants



01:45

02:05

02:20

02:40

02:23

02:37.5

3:00

Hour
ending
4:00

02:08

01:48

Start of 15 minute market

15-minute scheduled awards published

Results of all base tests published

Results of all base tests published

Market operator

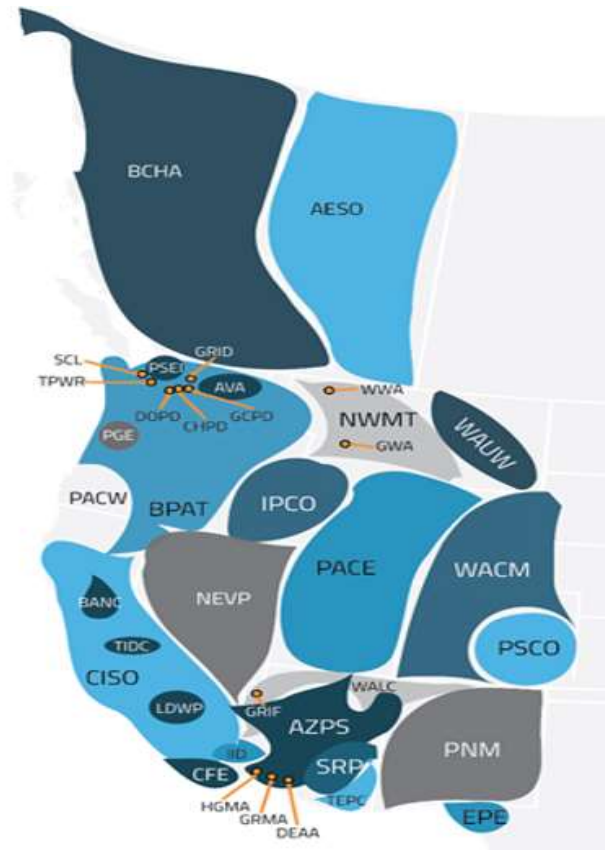
Balancing, Inputs and Outputs, and Resource Sufficiency

EIM ROLES AND RESPONSIBILITIES

The BAA's Reliability Responsibilities

To ensure frequency is maintained throughout the interconnection it is the responsibility of the balancing authority to ensure the balancing authority area does not exceed the Balancing Authority ACE Limit (BAAL) for more than 30 consecutive minutes.

NERC reliability standard BAL-001-2



What are some of the EIM roles and their functions?

ISO

Real-time Market Operator (RTMO)

EIM
Entity

EIM Operator

Trader / Marketer

Scheduler

Settlements

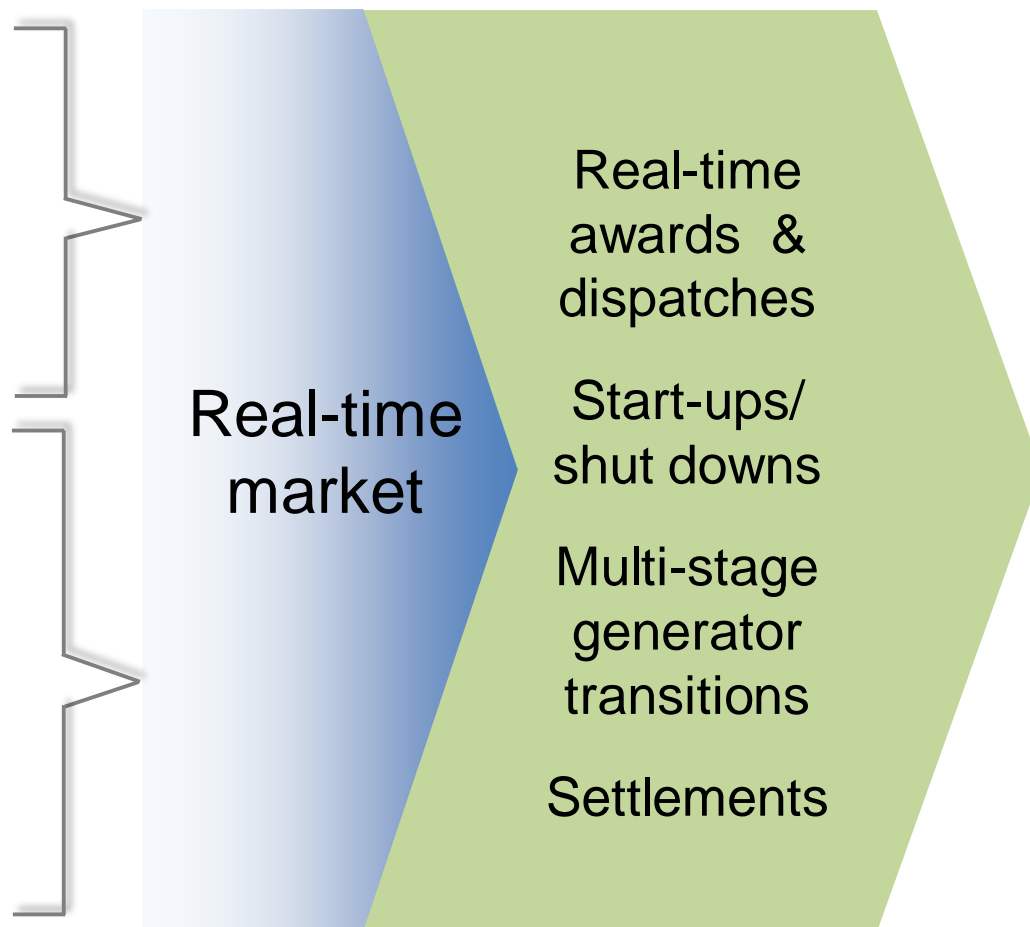
Inputs and outputs of the **real-time** market

From **day-ahead**:

- System info
- Energy schedules
- Reserves awards
- Master file

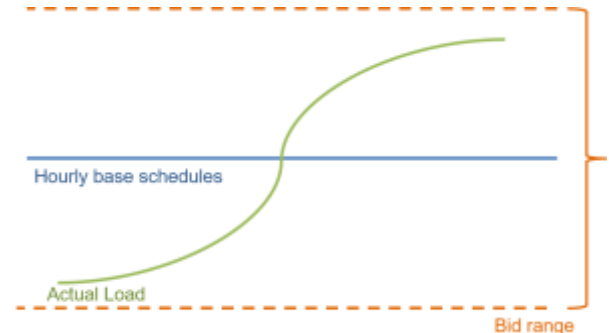
From **real-time**:

- State estimator
- ★ Energy Bids
- ★ Base schedules
- Outages
- Transmission limits



The BAA's resource plan ensures the balance, feasibility and flexibility of your base schedules and bids for prior to each operating hour

- Base schedules
 - Include hourly forecasts of load, hourly generation schedules and hourly interchange schedules.
 - Used as the baseline for financial settlements
- Bids
 - Indicators of willingness to buy/supply energy and capacity into the energy market



Load forecasts help determine the base schedule

- Demand forecast is used to determine the amount of supply that will be needed.
- The ISO forecasts demand on an hourly basis for the next 3 days.
- For load and renewable resources, EIM entities can choose to use:

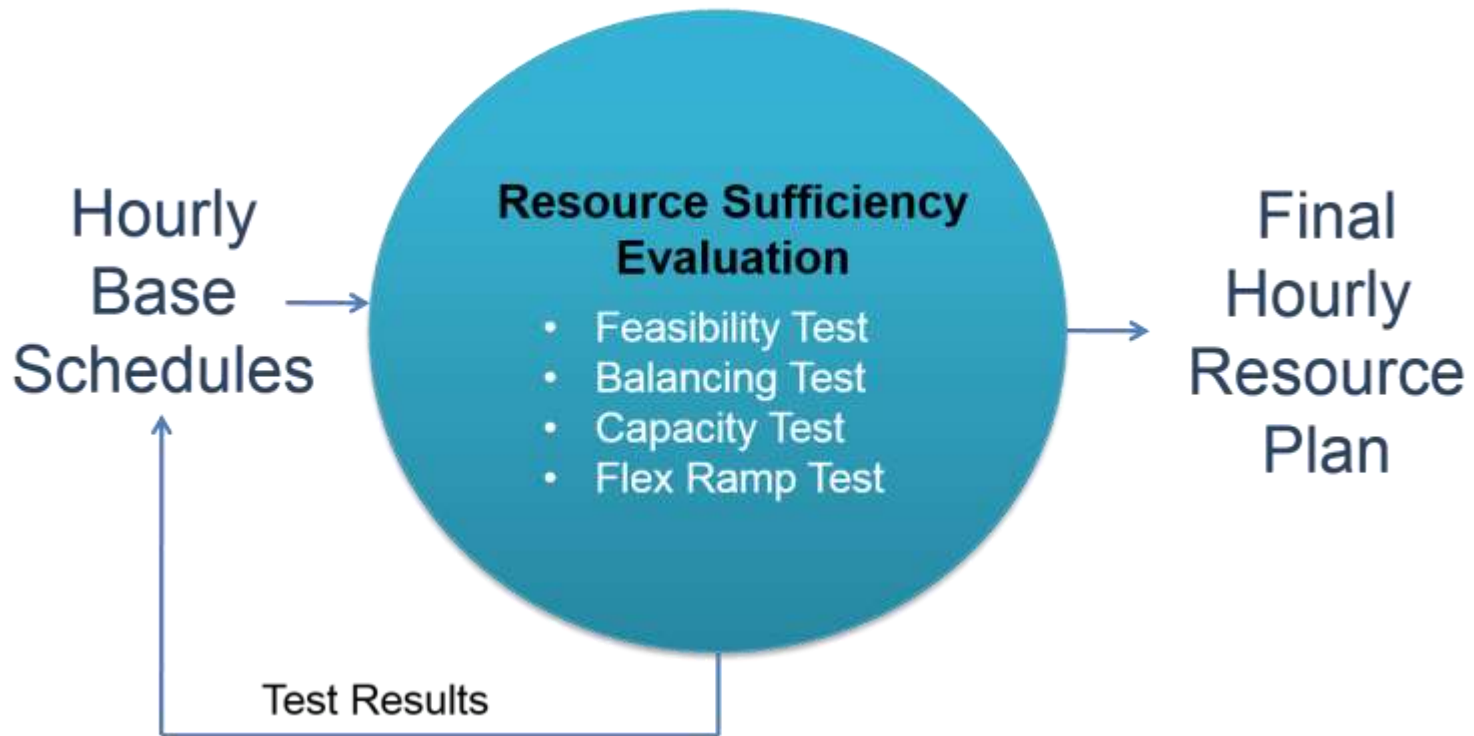


ISO Forecast

or

EIM Entity Forecast

Evaluations are conducted to ensure adequate resource are available to meet forecasted needs



Every hour, EIM entities demonstrate they have adequate capacity to balance load and manage contingencies in their own BAA

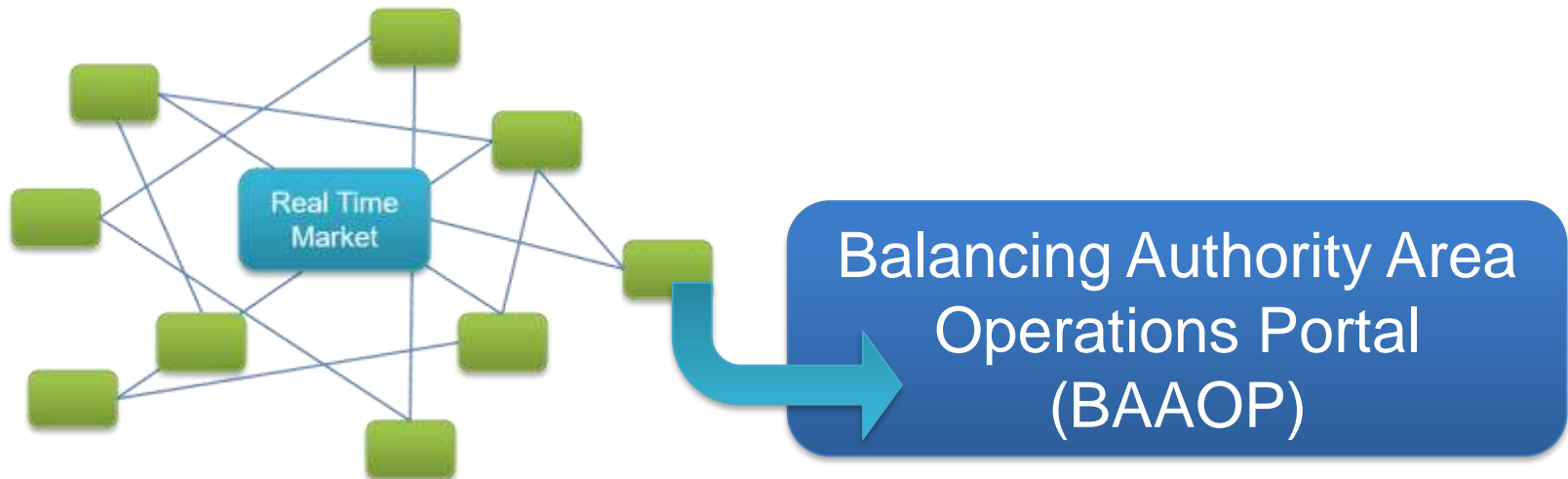
4 tests run 3 times per hour:

- **Balancing** ensures each BAA has the capability of balancing their area for each operating hour to avoid leaning on neighbors
- **Bid capacity** ensures a flexible bid range, both up and down on participating resources
- **Flexible ramp** is an aggregation of all resources to meet the slope of the load curve
- **Feasibility** ensures your base schedule would not overload a line

Situational Awareness and Troubleshooting

EIM TOOLS OVERVIEW

The ISO provides a network of applications that provide situational awareness



- BAAOP is an example of one of the many applications the ISO makes available to its market participants.
- This user interface provides the link between the market and EMS for EIM real-time market operators.
- Integrated system information aids critical thinking and effective decision making

ISO Markets and Training Reference

WHERE CAN YOU FIND MORE?

Visit the ISO website for information and resources

The screenshot shows the California ISO website homepage. At the top, there is a navigation bar with links: Calendar, Today's Outlook, Recent Documents, Daily Briefing, Careers, and Contact Us. Below this is the California ISO logo and a search bar. A main banner features a sunset over solar panels with the text "Greening the electric grid for future generations". Below the banner, there are several sections: "Subscribe to the Daily Briefing" (an email digest of the day's market notices), "2019 SUMMER READINESS" (Key topics), "Going green" (a leaf icon), and "RC WEST" (Visit page). The "Today's Outlook" section for AS OF 07:46 (09/26/2019) displays four key metrics: 28,625 MW Current demand (lightbulb icon), 34,796 MW Forecasted peak (sawtooth icon), 4,937 MW Current renewables (leaf icon), and 17% Renewables acting load (leaf icon). Below this is a "Calendar" section with tabs for News Releases, Recent Documents, and Market Notices. The calendar lists events for Thursday, 09/26/2019, Friday, 09/27/2019, Monday, 09/30/2019, Tuesday, 10/01/2019, Wednesday, 10/02/2019, and Thursday, 10/03/2019. At the bottom, there are four columns: "QUICK LINKS" (Board, Business Practice Manuals, Careers, Tariff), "STAY INFORMED" (Alerts, Warnings and Emergency Notifications, Daily Briefing, Subscriptions and notifications, Recent Documents), "RELATED WEBSITES" (Market Participant Portal (DASIS), Western EIM, Developer, RC West Portal), and "STAY CONNECTED" (RSS, Facebook, Twitter, YouTube, LinkedIn, Instagram).

Calendar Today's Outlook Recent Documents Daily Briefing Careers Contact Us

California ISO

ABOUT US PARTICIPATE STAY INFORMED PLANNING MARKET & OPERATIONS RULES ISO EN ESPAÑOL

Greening the electric grid for future generations

Subscribe to the Daily Briefing
an email digest of the day's market notices >>

2019 SUMMER READINESS

Key topics

Going green

RC WEST
Visit page>>

Today's Outlook AS OF 07:46 (09/26/2019)

28,625 MW Current demand

34,796 MW Forecasted peak

4,937 MW Current renewables

17% Renewables acting load

Calendar News Releases Recent Documents Market Notices

THURSDAY, 09/26/2019
iCal 10:00 AM - 12:00 PM 2019-2020 Transmission Planning Process
iCal 10:00 AM - 12:00 PM Welcome to the ISO Webinar
iCal 10:15 AM - 11:00 AM Market Update
iCal 2:00 PM - 3:00 PM Fall 2019 Release: Market Simulation Call

FRIDAY, 09/27/2019
iCal 9:00 AM - 12:00 PM Price Performance Analysis

MONDAY, 09/30/2019
iCal 1:00 PM - 3:00 PM Market Settlements Timeline - Draft Final Proposal
iCal 2:00 PM - 3:00 PM Fall 2019 Release: Market Simulation Call

TUESDAY, 10/01/2019
iCal 10:00 AM - 11:00 AM Technical User Group

WEDNESDAY, 10/02/2019
iCal 10:00 AM - 11:00 AM Market Settlement User Group
iCal 10:00 AM - 4:00 PM 2019 Legal Forum

THURSDAY, 10/03/2019

QUICK LINKS
Board
Business Practice Manuals
Careers
Tariff

STAY INFORMED
Alerts, Warnings and Emergency Notifications
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RELATED WEBSITES
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WESTERN ENERGY IMBALANCE MARKET

About **Join EIM** Governance Initiatives Resources Search

The Western Energy Imbalance Market is a real-time wholesale energy trading market that enables participants anywhere in the West to buy and sell energy when needed. EIM has generated hundreds of millions in gross benefits.

NEWS
EIM benefits reach \$801.07 million
[View the news release](#)

Quarterly benefits & ISO Greenhouse Gas Emissions Tracking Reports
[Go to reports >>](#)

Join Western EIM >>

\$64.81m savings in Q3 2019
[Read full report >>](#) [Read news release >>](#)
(millions \$)

TOTAL \$801.07m
gross benefits since Nov 2014

Arizona Public Service	20.36
BANC	4.37
California ISO	5.77
Idaho Power	5.36
NV Energy	5.92
PacifiCorp	9.54
Portland General Electric	9.48
Powerex	1.04
Puget Sound Energy	2.97

News & Notifications >>
See the latest developments in the EIM and subscribe for news releases and market notices.

Steps and documentation for joining the ISO

<https://www.westerneim.com/pages/default.aspx>

Visit our Learning Center to find online resources and comprehensive training programs



ABOUT US PARTICIPATE STAY INFORMED PLANNING MARKET & OPERATIONS RULES ISO EN ESPAÑOL

Home > Participate > Learning center

Learning center

The California ISO is committed to providing our customers with a broad menu of high-quality training courses on the ISO market functionality, as well as individual market applications. These courses are organized into learning tracks that are designed to be an industry resource for market participants and the general public to learn about electric grids and markets, and the ISO's role in the electricity system.

Video tour of the learning center

Learning tracks

Click on a learning track to register for classes. Our courses are intended for market participants and the general public.

**Markets and operations**
Learn about the day-ahead and real-time markets and operations that enable participants to engage the ISO.

**Western Energy Imbalance Market**
Explore topics pertaining to the real-time energy imbalance market that enables participants to buy and sell energy when needed.

**Settlements and metering**
Courses for settlements and billing functions, Timelines for meter data submission, payment of invoices, and the process for submitting disputes.

**Congestion revenue rights**
Overview of the creation, allocation and auction of congestion revenue rights and associated processes.

**Reference**
Resources designed to help users interact with the ISO, navigate our website, and request applications.

Library

**Computer-based training**
Quick access to the library of computer-based training courses for all learning tracks.

Training calendar

New modules

EIM Resource Sufficiency Evaluation Enhancements
[Presentation](#) | [Video](#) | [Knowledge Article](#)

FERC 844 Uplift Cost Allocation Transparency
[Presentation](#) | [Video](#)

Western Energy Imbalance Market training

Explore topics pertaining to the real-time energy imbalance market that enables participants to buy and sell energy when needed.



Computer-based training courses

Get ready to participate in EIM

Leading the EIM transition

The basics of the real-time market

Base schedules foundational concepts

System outages foundational concepts

Metering foundational concepts

Settlements foundational concepts

Public EIM training resources

Continuous development of training that is relevant to our customers relies on feedback – let us hear from you today!

<http://www.caiso.com/participate/Pages/LearningCenter/default.aspx>



Open Access Same-time Information System (OASIS) provides public access to a variety of transmission system data

The screenshot displays the California ISO OASIS website. At the top, the California ISO logo and 'OASIS' text are visible, followed by navigation icons. Below this is a horizontal menu bar with links: ATLAS REFERENCE, REPORT DEFINITION, PRICES, TRANSMISSION, SYSTEM DEMAND, ENERGY, ANCILLARY SERVICES, CONGESTION REVENUE RIGHTS, and PUBLIC BIDS. The main content area is divided into two columns. The left column contains 'Standards Information' (North American Energy Standards Board (NAESB), ISO Business Practice Manuals, Available Transfer Capability Information) and 'System Help' (For interface technical specifications, product release plans and other supporting documents go to: System Technical Information). The right column features a map of California with three regions highlighted: NP15 (orange), ZP26 (blue), and SP15 (green). Below the map, a status bar shows 'For RT Interval 02:55 - LMP for' followed by prices: SP15=\$28.0404, NP15=\$28.86688, and ZP26=\$28.0803. At the bottom, there is a 'CONNECTED' status indicator, a 'QUICK LINKS' section with links to OASIS Home, System Operating Messages, LMP Price Contour Maps, Trading Hub Real-Time Prices, and Historical ACE, and the California ISO logo.

California ISO OASIS

ATLAS REFERENCE REPORT DEFINITION PRICES TRANSMISSION SYSTEM DEMAND ENERGY ANCILLARY SERVICES CONGESTION REVENUE RIGHTS PUBLIC BIDS

Standards Information
North American Energy Standards Board (NAESB)
ISO Business Practice Manuals
Available Transfer Capability Information

System Help
For interface technical specifications, product release plans and other supporting documents go to:
System Technical Information

NP15
ZP26
SP15

For RT Interval 02:55 - LMP for SP15=\$28.0404 NP15=\$28.86688 ZP26=\$28.0803

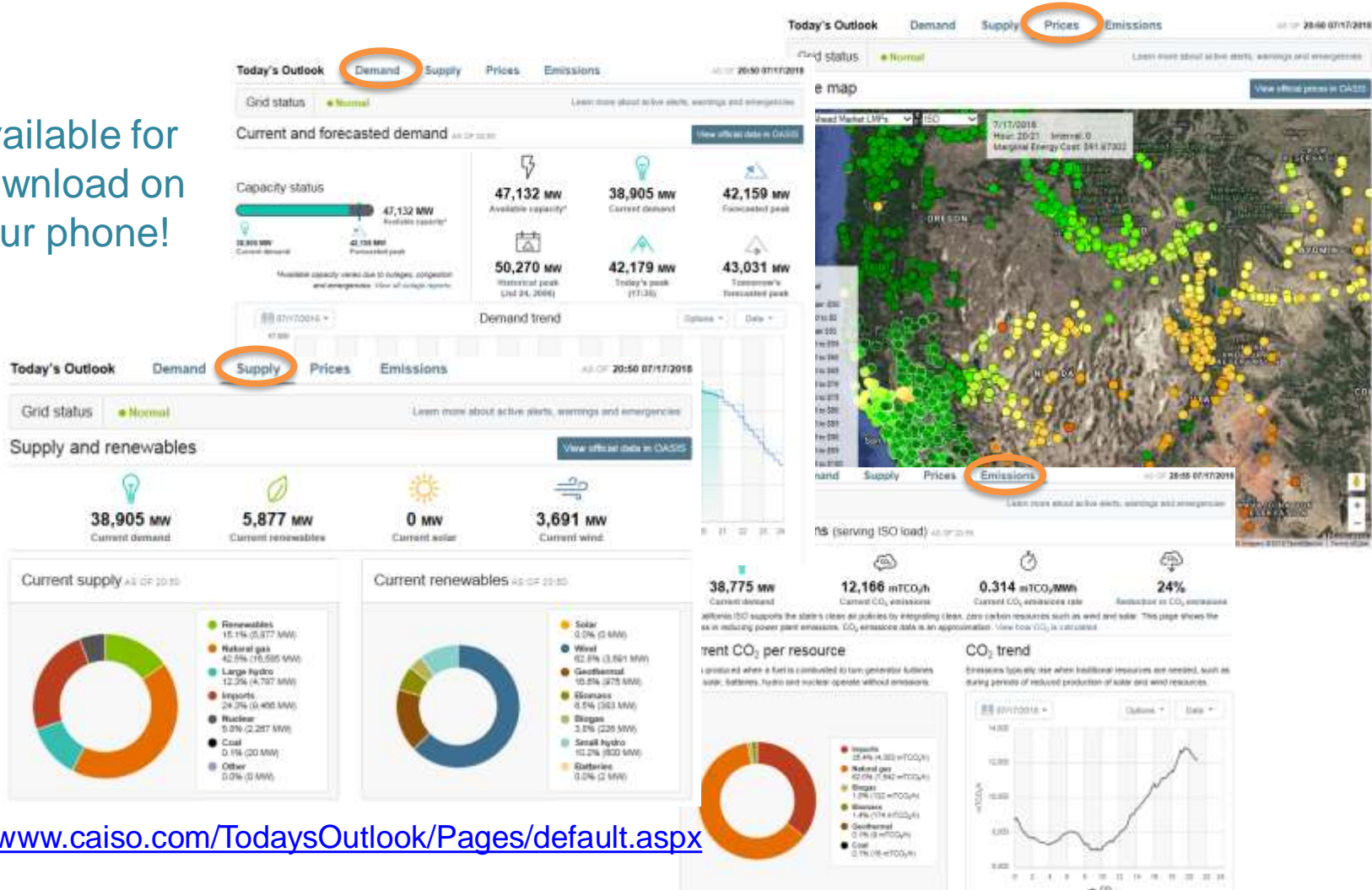
CONNECTED

QUICK LINKS
OASIS Home System Operating Messages LMP Price Contour Maps Trading Hub Real-Time Prices Historical ACE

<http://oasis.caiso.com/mrioasis/logon.do>

Today's Outlook provides users with a broad view of supply and demand conditions impacting the ISO

Available for download on your phone!



Business Practice Manuals (BPMs) provide detailed rules, procedures and examples

- Market participants are encouraged to participate in our Proposed Revision Request (PRR) process



- Visit the ISO calendar to find monthly meeting dates to discuss PRRs


<http://www.caiso.com/rules/Pages/BusinessPracticeManuals/Default.aspx>


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Subscriptions and notifications

We send out important notifications regarding ISO operations and markets, alerts and emergencies, and upcoming events.

**Daily Briefing**
Keep up to date on meetings, procedure and system changes, stakeholder initiatives and other important information about ISO operations and markets with a daily email summarizing the day's market notices.


**News releases**
Get the latest on the ISO, the decisions of our Board of Governors, and breaking developments in the energy industry.

**Energy Matters newsletter**
Stay informed of developments in energy that will impact your community and business. Many changes are coming to California's energy landscape as the electricity grid evolves.


**Flex Alerts**
A Flex Alert is a call for consumers to voluntarily conserve electricity when there is a predicted shortage of energy supply, especially if the grid operator needs to dip into reserves to cover demand. When consumers reduce electricity use at critical times, it can prevent more dire emergency measures, including possible power outages.

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Alerts, warnings and emergency notices

Find out when operating reserves or transmission capacity limitations threaten our ability to safely and reliably operate the grid. Receive notifications through our app or RSS.

[Click here to access notices.](#)

System operating messages

The ISO control room issues messages that describe current operational conditions on the grid and in the market. Access these notices on OASIS under Quick Links.

[Download ISO Today mobile app](#)



For more detailed information on anything presented, please
visit our website at:

www.caiso.com

Or send an email to:
CustomerTraining@caiso.com